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Does the Preoperative Varus Deformity Influence the Survival of Postoperative Neutral-Aligned TKAs? An Analysis With a Minimum 5-Year Follow-Up

Sung-Mok Oh, MD, Seong-Il Bin, MD, PhD *, Jae-Young Kim, MD, Hyun-Ik Cho, MD, Bum-Sik Lee, MD, Jong-Min Kim, MD

Department of Orthopedic Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Republic of Korea

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ABSTRACT

Background: Postoperative neutral alignment may be an important factor for longevity of total knee arthroplasty (TKA). In knees with severe varus deformity, greater soft tissue release and bone resection were required to achieve neutral alignment. We investigated the relationship between the severity of preoperative varus deformity and longevity of neutral-aligned TKAs.

Methods: Of the 723 knees in patients who underwent primary TKA for varus-type osteoarthritis between November 1998 and June 2009, 496 knees aligned neutrally (the postoperative mechanical hip-knee-ankle [HKA] axis angle ranged between −3° and 3°) and followed up for at least 5 years were included in the study. The mean follow-up period was 9.28 years. Patients were divided into 4 groups based on their preoperative HKAs: mild ($0° < HKA \leq 5°$, n = 79), moderate ($5° < HKA \leq 10°$, n = 204), severe ($10° < HKA \leq 15°$, n = 149), and very severe ($HKA > 15°$, n = 64) groups. Failure was defined as need for revisional TKA for mechanical reason. Survival was analyzed by Kaplan-Meier method and log-rank test.

Results: The overall failure rate was 2.02% (10 of 496 prostheses). The cumulative survival rates of neutral-aligned TKAs at 10 years were 97.4% (95% confidence interval [CI], 93.9%-100%), 99.0% (95% CI, 97.6%-100%), 97.8% (95% CI, 95.4%-100%), and 96.9% (95% CI, 92.6%-100%) in mild, moderate, severe, and very severe varus groups, respectively. There were no significant differences between group survival rates ($P = .395$).

Conclusion: The severity of preoperative varus deformity did not affect survival rates of neutral-aligned TKAs over 10 years.

Severity of preoperative varus malalignment is an important factor when deciding on total knee arthroplasty (TKA) for knees with varus-type osteoarthritis. In Korea, preoperative varus deformity was common in candidates for TKA and many elderly people with more severe varus deformities undergo TKA compared to patients in Western cultures [1]. Postoperative neutral alignment has been considered as a target alignment for successful TKA [2,3]. However, to achieve a neutral-aligned TKA, patients with greater preoperative varus alignment required a greater amount of soft tissue release and more complex bone resection [4,5]. In addition, patients who had adapted to varus alignment for a long time may not become accustomed to neutral alignment [6,7]. Therefore, the severity of preoperative varus malalignment could be a risk factor for poor clinical outcomes of neutral-aligned TKAs.

The effect of preoperative varus malalignment on longevity of TKAs is controversial [8–10]. It was reported to be a significant risk factor for aseptic loosening of TKAs in a previous study using short knee radiographs [9]. In contrast, several studies using full-length radiographs reported varus malalignment to be an insignificant factor [8,10]. Those studies considered patients with preoperative varus alignment as one group [8–10]. However, explanation of the effect of preoperative varus alignment seems insufficient because the range of varus angle is quite wide in cases of varus-type osteoarthritis [1]. Two studies have reported clinical outcomes of TKAs

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* Reprint requests: Seong-Il Bin, MD, PhD, Department of Orthopedic Surgery, Asan Medical Center, University of Ulsan College of Medicine, 88, Olympic-ro 43-gil, Songpa-gu, Seoul 05505, Republic of Korea.

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according to the preoperative varus deformity [11,12]. One study performed survivor analysis and reported no significant difference between groups [12], and the other reported no significant difference in clinical knee scores between groups [11]. However, the former study used short knee radiographs to evaluate postoperative alignment with a short mean follow-up of approximately 5 years [12]. In the latter study, the survivor analysis could not be performed because there was no failure in their cohort, and also a small number of patients [11]. To the best of our knowledge, no analysis has yet been done on the survival of TKAs according to severity of the preoperative varus deformity using long-standing films in large numbers of patients with a mean follow-up of over 5 years.

This study examined, as preoperative varus deformities were increased, whether the survivorship of TKAs was worsened although postoperative alignment was neutral. A comparative study was conducted in terms of post-TKA failures in knees with mild, moderate, severe, and very severe preoperative varus deformities. We hypothesized that, as preoperative varus alignment increased, longevity of TKAs may reduce in postoperative neutral-aligned TKAs.

Materials and Methods

This study was approved by our institutional review board (IRB No.2017-1124). Between November 1998 and June 2009, we performed 1299 cemented, posterior cruciate ligament–substituting knee surgeries in 867 patients with primary osteoarthritis. Preoperative long-standing films were obtained in all patients. We excluded 105 patients whose postoperative long-standing films after index surgery were not available; 58 whose preoperative and postoperative long-standing films were not truly in the anteroposterior direction and, thus, were inappropriate for measuring mechanical alignment; patients (n = 10) who had a history of osteotomy, hip arthroplasty, or extra-articular deformity that could affect their ipsilateral limb alignment; patients (n = 14) with prosthetic joint or periprosthetic infection, or periprosthetic fractures; and patients (n = 340) who were lost to follow-up before a minimum of 5 years. Then, we excluded patients (n = 49) who had preoperative valgus or neutral alignment (mechanical hip-knee-ankle [HKA] axis angle $\leq 0^\circ$). Consequently, 723 varus-type osteoarthritic knees (HKA $> 0^\circ$) in 486 patients were screened. Among them, we excluded postoperative valgus-aligned or varus-aligned TKAs (HKA $< -3^\circ$ or HKA $> 3^\circ$) [6,8]. Finally, 496 neutral-aligned ($-3^\circ \leq$ postoperative HKA $\leq 3^\circ$) varus-type osteoarthritic knees (preoperative HKA $> 0^\circ$) in 333 patients were enrolled into this study. Patients were divided into 4 groups based on the preoperative HKA: mild varus ($0^\circ <$ HKA $\leq 5^\circ$, n = 79), moderate varus ($5^\circ <$ HKA $\leq 10^\circ$, n = 204), severe varus ($10^\circ <$ HKA $\leq 15^\circ$, n = 149), and very severe varus (HKA $> 15^\circ$, n = 64) groups [11,12] (Fig. 1). Four patients died during follow-up without revision. Demographics and radiologic parameters of the 4 groups according to preoperative varus deformity degrees are described in Table 1.

Surgical Technique

All surgeries were performed by 1 senior surgeon (SI Bin). A conventional technique without computer assistance was used and only a NexGen system (LPS or LPS-Flex system; Zimmer, Warsaw, IN) was applied. The standard anterior midline skin incision and medial parapatellar arthrotomy were performed. After release of the deep medial collateral ligament (MCL) and posteromedial capsule, distal femoral and proximal tibial bone cutting was done using the intramedullary alignment guide. After tibial cutting, the posterior cruciate ligament was resected. Posterior capsular release was performed according to the degrees of flexion contracture and

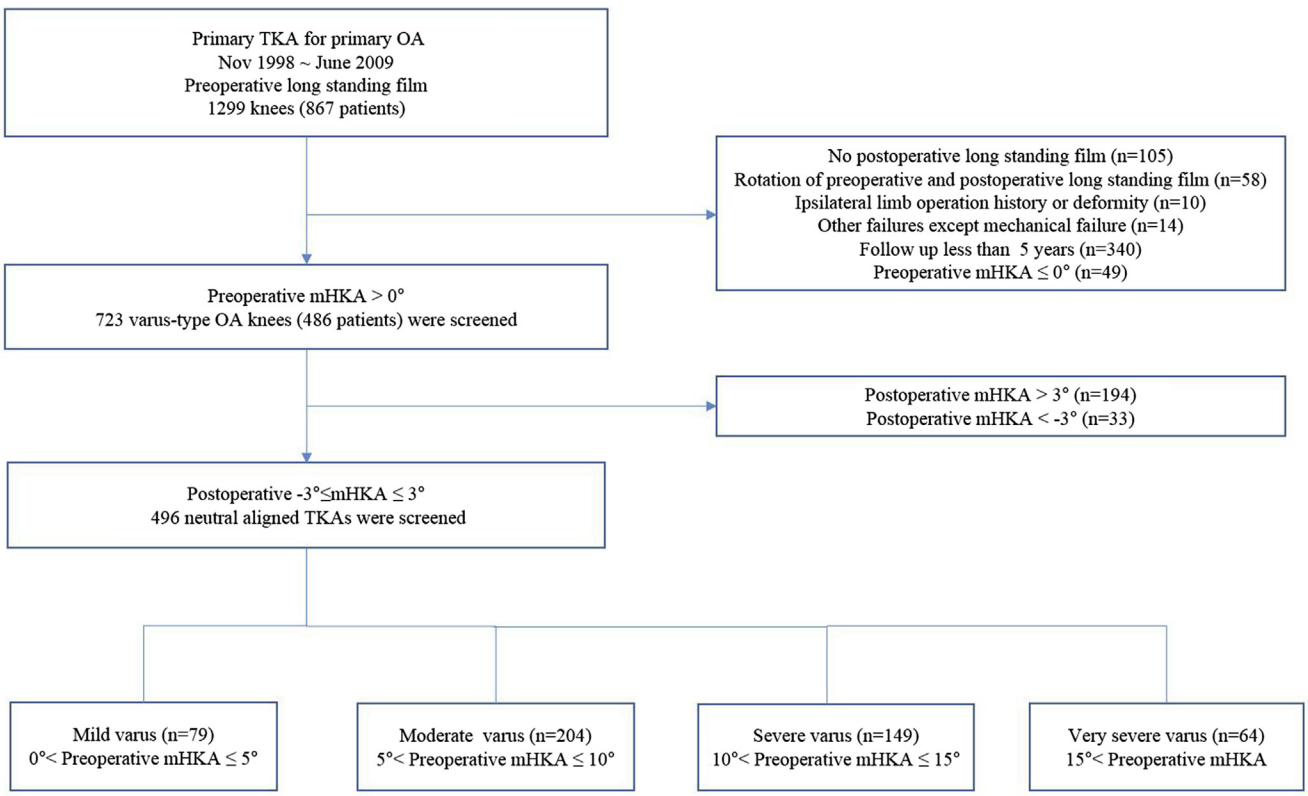

Fig. 1. Flowchart. mHKA, mechanical hip-knee-ankle axis angle; OA, osteoarthritis; TKA, total knee arthroplasty.